

California Science Content Standards

the talk

Life On Earth: Instructions in Three Billion (tiny) Letters or Less

links with the following standards:

1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:

- a. *Students know* cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
- b. *Students know* enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
- c. *Students know* the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.
- d. *Students know* most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

2. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:

- a. *Students know* the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.
- b. *Students know* how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.
- c. *Students know* how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.
- d. *Students know* specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.
- e. *Students know* proteins can differ from one another in the number and sequence of amino acids.
- f. *Students know* why proteins having different amino acid sequences typically have different shapes and chemical properties.